

DETAILED ACTION

Finality of the Office action mailed on 28 February 2011 is withdrawn in response to the Pre-appeal brief filed on 31 May 2011.

Claim Status

Claims 1-39 are pending.

Claims 6-7, 12-13, 18-19, 24-25, 30-31, and 36 are withdrawn as being directed to a non-elected invention, the election having been made on 19 March 2007.

Claims 1-5, 8-11, 14-17, 20-23, 26-29, 32-35, and 37-39 have been examined.

Claims 1-5, 8-11, 14-17, 20-23, 26-29, 32-35, and 37-39 are rejected.

Priority

This application was filed on 20 February 2004 and makes no claims to the benefit of any earlier filed applications.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claim 14 rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claims are drawn to a computer program on computer readable media. A review of the specification does not show a definition of computer readable media such that excludes an embodiment that is information in a signal. As such an embodiment of the claims read on non-statutory subject matter (In re Nuijten 84 USPQ2d 1495 (2007)).

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-5, 20-23, and 37 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1 and 20 recite the phrase "A system for" and recites limitations directed to method step. The metes and bounds of the claim are rendered indefinite by the ambiguity caused by limitations to both a process and an apparatus in the same claim. The active method language of the claim further suggests that what is being claimed is the functioning apparatus, not the apparatus itself or the process itself. A single claim which claims both an apparatus and the method steps of using the apparatus is indefinite under 35 U.S.C. 112, second paragraph. *IPXL Holdings v. Amazon.com, Inc.*, 430 F.2d 1377, 1384, 77 USPQ2d 1140, 1145 (Fed. Cir. 2005); *Ex parte Lyell*, 17 USPQ2d 1548 (Bd. Pat. App. & Inter. 1990) (claim directed to an automatic transmission workstand and the method of using it held ambiguous and properly rejected under 35 U.S.C. 112, second paragraph). If applicant intended the components of the system to be "capable of" performing the active method steps or if applicant intended the components of the system to "comprise instructions", then amendment of the claims would be appropriate. Claims 2-5, 21-23, and 37 are also rejected because they depend from claims 1 and 20, and thus contain the above issues due to said dependence.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

The following rejection is necessitated by amendment.

Claims 1-5, 8-11, 14-17, 20-23, 26-29, and 32-35 and are rejected under 35 U.S.C. 103(a) as being unpatentable over Sauro et al., in view of Kurata et al., in view of Funhashi et al. (Biosilico, Vol. 1 No. 3, p. 159-162, 2003 November), and in view of Thalhammer-Reyo (WO 96/22575).

The claims are directed to a system, computer-implemented method, and computer program product for improved modeling of a biological system, a biological system being a plurality of chemical reactions, comprising a modeling component with a graphical user interface to generate a model; a simulation engine accepting the model and generating a dynamic behavior for the biologic system; and an analysis environment that interfaces with data acquisition hardware that gathers experimental data and using output to control an experiment.

Sauro et al. show a system, computer-implemented method, and computer program product for improved modeling of a biological system, a biological system being a plurality of chemical reactions, comprising a modeling component with a graphical user interface (GUI) to generate a model; a simulation engine accepting the model and generating a dynamic behavior for the biologic system; and an analysis environment to display the dynamic behavior (figure 11). The system implemented by Sauro et al. integrates several stand-alone programs in a way such that the inputs and outputs of each program can be exchanged with the other programs, i.e. the programs are SBW-compliant or enabled. Sauro et al. shows the integration of the programs of JDesigner, Jarnac, and SBW Meta-tool (p. 365, Applications). In figure 11 of Sauro et al., the elements of modeling component having a GUI providing means for accepting

Art Unit: 1631

user input via a tool palette to generate a block diagram of a plurality of related chemical reactions that make a biological system. The figure also depicts an analysis environment displaying the dynamic behavior of the biological system, and a simulation engine. The system of Sauro et al. integrates several different programs as components and facilitates the intercommunication of the programs to provide a dynamic, high performance framework for modeling biological systems and reaction pathways (p. 355). Figure 12 shows that in addition to depicting the model graphically, the model is also displayed as a table. Figure 12 shows screen shot of JDesigner interfaced with METATOOL. Sauro et al. shows JDesigner acts as a model editor from which users can initiate simulation and METATOOL analysis (p. 368). In the lower left portion of figure 12, the tabular view of METATOOL displays the modes, sets of enzymes working together at steady state to construct a plausible subpathways, of the reactions representative of the model displayed in graphical format in the center of figure 12. Thus, Sauro et al. shows the adaptation of the tabular view to receive user commands and input to construct the model. Sauro et al. shows that the dynamic behavior of the system is modeled using a stochastic computational model (p 355 and 364). Sauro et al. also shows that models are entered in the form of a script stored in SBML level 1. Sauro et al. shows the JARNAC tool is a script based simulation tool using models stored in SBML level 1 (p. 366). The SBML script is another tabular form of a model. Sauro et al. shows the simulation may be a timed course simulation, a simulation which terminates after predefined length of time, reading on the limitation of the occurrence of a predefined simulation termination condition (p. 366).

Sauro et al. does not explicitly show the display of one or more reactions in tabular form.

Kurata et al. shows a computational system for the modeling of biochemical reaction networks. Kurata et al. shows that a portion of the model is displayed in tabular form and the tables have at least one chemical reaction (figure 3). Kurata et al. shows the benefit of the GUI is it allows one to draw and describe a large-scale map of molecular networks (p. 4076, col. 1). Kurata et al suggests the CADLIVE system not only constructs a large-scale map of complicated signal transduction pathways based on the information provided by molecular biology, but also has the capability to map the heterogeneous experimental data derived from DNA microarrays and proteomics studies on a biochemical network of interest (4084, col. 1).

Sauro et al. in view of Kurata et al. do not show a reaction table with a plurality of reactions and a species table that depicts at least one initial condition and amount of material.

Funhashi et al. shows in figure 1 table of reactions (bottom left) with a plurality of reaction and a table of species (bottom right) with at least an initial condition and an amount of a starting material. The relevant portion of figure 1 is included here for clarity.

id	name	type	rate	species	product	initial
STATE_TRANSITION_1	State 1	State	1.0	1.0	1.0	1.0
STATE_TRANSITION_2	State 2	State	1.0	1.0	1.0	1.0
STATE_TRANSITION_3	State 3	State	1.0	1.0	1.0	1.0
STATE_TRANSITION_4	State 4	State	1.0	1.0	1.0	1.0
STATE_TRANSITION_5	State 5	State	1.0	1.0	1.0	1.0
STATE_TRANSITION_6	State 6	State	1.0	1.0	1.0	1.0
STATE_TRANSITION_7	State 7	State	1.0	1.0	1.0	1.0
STATE_TRANSITION_8	State 8	State	1.0	1.0	1.0	1.0
STATE_TRANSITION_9	State 9	State	1.0	1.0	1.0	1.0
STATE_TRANSITION_10	State 10	State	1.0	1.0	1.0	1.0

name	id	initial	comp	rate	units	min	max	val
Species 1	1	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Species 2	2	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Species 3	3	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Species 4	4	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Species 5	5	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Species 6	6	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Species 7	7	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Species 8	8	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Species 9	9	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Species 10	10	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Funhashi et al. shows the standardized model description enhances the portability of the models between software tools (p. 160, col. 1).

Thalhammer-Reyo shows methods and systems for simulating biochemical processes. Thalhammer-Reyo shows that simulation system or engine is interfaced and integrated with an experiment (p. 10). In the case of Thalhammer-Reyo the experiment is a biological reactor or reactor. Thalhammer-Reyo shows that a data acquisition hardware is monitored by a monitoring interface that acts as bridge to pass information from the experiment to the model (p. 10). Thalhammer-Reyo shows the model transmits information to controller hardware to regulate the operation of the experiment (p. 10). Thalhammer-Reyo shows the system models the dynamic behavior of the processes of the experiment and involves any number of variable to be monitored, including those measured and monitored in the experiment and those simulated and monitored in the model, which are both used as inputs for an inference engine to be compared against each other or other specified values and which meeting the specified conditions (a predetermined amount) trigger actions that result in the control of the experiment (p. 11). Thalhammer-Reyo shows the system advantageously provides a means to build detailed mechanistic models of the complex systems involved; and to use inference methods that integrate the simulation of virtual models with inputs from monitoring devices to allow for the intelligent control of the operation of complex systems (p. 4).

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the biological simulation system of Sauro et al. with the display of Kurata et al. because Kurata et al. shows that a benefit of the display is it allows one to draw and describe a large scale map of molecular networks. It would have been further obvious to one of skill in the art at the time of invention to modify the biological

Art Unit: 1631

simulation of Sauro et al. in view of Kurata et al. with the tabular views of Funhashi et al. because Funhashi et al. shows standardized model description enhances the portability of the models between software tools. It would have been further obvious to one of ordinary skill in the art at the time of invention to modify the biological simulation system of Sauro et al. with the display of Kurata et al. and the editing of reaction and species via a tabular view of Funhashi et al. because all the claimed elements were known, in the prior art, and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art at the time of the invention. It would have been further obvious to one of ordinary skill in the art at the time of invention to modify the biological simulation system of Sauro et al. using the display of Kurata et al. and the editing of reaction and species via a tabular view of Funhashi et al. with the interfacing of data acquisition hardware and control hardware for an experiment of Thalhammer-Reyo because Thalhammer-Reyo shows the system advantageously provides a means to build detailed mechanistic models of the complex systems involved; and to use inference methods that integrate the simulation of virtual models with inputs from monitoring devices to allow for the intelligent control of the operation of complex systems.

Response to Arguments

Applicant's arguments filed 31 May 2011 have been fully considered but they are not persuasive. Applicant argues that the information gathered in Thalhammer-Reyo occurs at the wrong time and that the claims have been amended to clarify "the output

Art Unit: 1631

of the simulation engine which is used to control the experiment represents the dynamic behavior of the biological system at a completion of the simulation" (response of 31 May 2011, p. 2-3, last paragraph). Thalhammer-Reyo shows the system models the dynamic behavior of the processes of the experiment and involves any number of variable to be monitored, including those measured and monitored in the experiment and those simulated and monitored in the model, which are both used as inputs for an inference engine to be compared against each other or other specified values and which meeting the specified conditions (a predetermined amount) trigger actions that result in the control of the experiment (p. 11). The phrase "a completion of the simulation" and a conclusion of an experiment" are broadly interpreted to be directed to not only the last measurement of an experiment or the last value of a simulation, but also include measurements taken from ongoing experiments and values generated by ongoing simulations. For example, Sauro et al. shows that simulations can be executed as time course simulations. Time course simulation progress along a trajectory defined by a predetermined change in time, Δt . The output from a time course simulation at any given time, t , during the simulation is the output at a completion of the simulation for that time t similarly for experiments. Thus, the showing in Thalhammer-Reyo of the iterative cycle of data acquisition, comparison to the model, and modification of the experiment leading to an improved experiment reads on the invention as currently amended. With respect to applicants arguments regarding independent claims 8, 14, 20, 26, and 32, applicant similarly argues that the combination of Sauro et al., in view of Kurata et al., in view of Funhashi et al. and Thalhammer-Reyo fail to disclose or suggest the output

Art Unit: 1631

used to control a property of the experiment represent the expected result at a completion of the simulation. The argument is not persuasive for the reasons above.

The following rejection is reiterated from the previous action.

Claim 37-39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sauro et al. and in view of Kurata et al. in view of Funhashi et al. and in view of Thalhammer-Reyo as applied to claims 1-5, 8-11, 14-17, 20-23, 26-29, and 32-35 above, and further in view of Shannon et al. (Genome Research, Vol. 13, p. 2498-2504, 2003) and in view of Biospice (Presentation of Biospice, DARPA BioComp, May 2002).

Claims 37-39 are directed to embodiments in which user annotations are displayed in a column in a table and in a location close to an element in the graphical view.

Sauro et al. and in view of Kurata et al. in view of Funhashi et al. and in view of Thalhammer-Reyo as applied to claims 1-5, 8-11, 14-17, 20-23, 26-29, and 32-35 above show a computational system for modeling chemical reactions.

Sauro et al. and in view of Kurata et al. in view of Funhashi et al. and in view of Thalhammer-Reyo does not explicitly show user annotations are displayed in a column view and in a location close to an element in the graphical view.

Shannon et al. shows a system for simulating biochemical reactions and interactions. Shannon et al. shows that data is integrated with the graph model using attributes (p. 2499, col. 2). Shannon et al. shows that attribute values may assume any type (e.g., text strings, discrete or continuous numbers, URLs, or lists) and are either

Art Unit: 1631

loaded from a data repository or generated dynamically within a session reading on user annotations (p. 2499, col. 2). Shannon shows in figure 1a table with annotations in a column view. Shannon et al. shows that it is possible to have many levels of annotation all active and on display at the same time, each as a different attribute on the nodes or edges of interest (p. 2500, col. 1-2). Shannon et al. shows that annotations are transferred on to the nodes and edges (p. 2500, col. 1). Shannon et al. shows that by visually superimposing molecular states on the interaction pathways hypothesized to regulate those states, attribute-to-visual mappings directly connect observed data to an underlying model (p. 2500, col. 2).

Biospice shows annotations are localized close to elements in the graphical view (p. 32).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system for modeling biochemical reactions of Sauro et al. and in view of Sauro et al. and in view of Kurata et al. in view of Funhashi et al. and in view of Thalhammer-Reyo as applied to claims 1-5, 8-11, 14-17, 20-23, 26-29, and 32-35 above with annotations in a column and localized close to elements in the graphical view as shown by Shannon et al. and Biospice because all the claimed elements were known, in the prior art, and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art at the time of the invention. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify

Art Unit: 1631

the system for modeling biochemical reactions of Sauro et al. and in view of Kurata et al. in view of Funhashi et al. and in view of Thalhammer-Reyo as applied to claims 1-5 and 20-23 above with annotations in a column and localized close to elements in the graphical view as shown by Shannon et al. and Biospice because Shannon et al. shows by visually superimposing molecular states on the interaction pathways hypothesized to regulate those states, attribute-to-visual mappings directly connect observed data to an underlying model.

Response to Arguments

Applicant's arguments filed 31 May 2011 have been fully considered but they are not persuasive. Applicant argues Shannon et al. and Biospice fail to remedy the deficiency of Sauro et al. and in view of Kurata et al. in view of Funhashi et al. and in view of Thalhammer-Reyo with respect to the limitation of at a completion of the simulation. The argument is not persuasive for the reasons provided above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KARLHEINZ R. SKOWRONEK whose telephone number is (571)272-9047. The examiner can normally be reached on 8:00am-5:00pm Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marjorie Moran can be reached on (571) 272-0720. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1631

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/KARLHEINZ R SKOWRONEK/
Primary Examiner, Art Unit 1631

20 July 2011